

## Ch. 8 Cellular Energy

## Section 8.1 → How Organisms obtain Energy

## I. Transformation

A. Chemical reactions + processes are constantly occurring in your cells

1. All of the cells require energy (ATP), the ability to do work

B. Laws of thermodynamics

1. 1st law = law of conservation of energy  
a. energy cannot be created nor destroyed

2. Entropy, the measure of disorder, or usable energy

C. Autotrophs + heterotrophs (all organisms need energy to live)

D. Metabolism - all of the chemical reactions in a cell

1. Metabolic pathways include two major types:  
→ catabolic + anabolic

a. Catabolic - release energy; large → small

b. Anabolic - use energy to build large molecules from small molecules

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2. Photosynthesis - anabolic pathway in which light energy from the sun is converted to chemical energy

3. Cell respiration - catabolic pathway in which organic molecules are broken down to release energy for cell

## II ATP: the unit of cellular energy

A. ATP (Adenosine triphosphate) is the most important biological molecule that provides chemical energy

B. ATP is a nucleotide made of an adenine base, a ribose sugar, and 3 phosphate groups

1. ATP releases energy when the bond between the 2nd and 3rd phosphate groups is broken

a.  $ATP \rightarrow ADP$  : yields energy

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# 8.1 Review

Grade: 10th  
Subject: Biology  
Date: 12/13

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1 What does the first law of thermodynamics state?

A entropy increases

C metabolism decreases

D chemicals are produced

B energy is conserved

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2 Autotrophs that convert light energy into chemical energy are called \_\_\_\_\_.

- A heterotrophs
- B chemoautotrophs
- D omnivores

C photoautotrophs

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3 All chemical reactions in an organism's cells are called \_\_\_\_\_.

- A chemotrophy
- B autotrophy
- C thermodynamics

D metabolism

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4 What chemical bond in ATP releases when broken down?

- B sulfur
- C oxygen
- D potassium

A phosphate

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5 The second law of thermodynamics states....

- A ability to do work is energy
- C the idea that energy cannot be created nor destroyed
- D catabolic pathways break down organic molecules

B spontaneous increase in disorder, entropy

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## 8.2 Photosynthesis

## I. Overview of Photosynthesis

A. Equation:  $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ 

B. Occurs in two phases

1. Phase 1 (light-dependent)

a. Electron transport

2. Phase 2 (light-independent)

b. Calvin Cycle

C. Chloroplasts - disc-shaped organelles that contain two main compartments essential to photosynthesis

1. Thylakoids - flattened, sac-like membranes arranged in stacks

a. Stacks are called grana

2. Stroma - fluid-filled space that's outside the grana

D. Pigments - light absorbing, colored molecules found in thylakoid membranes of chloroplasts

1. Major light-absorbing pigments in plants = chlorophylls

E. Electron transport (1st step of photosynthesis)

\* → know steps of electron transport (p. 453) Figure 10

F. Calvin Cycle (2nd phase of photosynthesis)

\* → Figure 11 (pg. 455)

1. Enzyme Rubisco converts inorganic  $\text{CO}_2$  molecules into organic molecules that can be used by the cell

a. This is known as carbon fixation

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## II Alternative Pathways

A. Many plants in extreme environments have alternative photosynthesis pathways

B.  $\text{C}_4$  plants - fix  $\text{CO}_2$  into 4 carbon compounds instead of 3 in Calvin Cycle

1. minimizes water loss

C. CAM (Crassulacean acid metabolism) plants

1. Occurs in dry areas where access to water is limited

2. Process allows  $\text{CO}_2$  only to enter plant at night when atmosphere is cooler and there is less humidity

a. process also minimizes water loss

3. Carbon fixation at night of organic  $\text{CO}_2$  molecules then enter Calvin Cycle during day to minimize water loss

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## 8.2 Review

Grade: 10th  
Subject: Biology  
Date: 1/2/12

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1 Light absorbing colored molecules called \_\_\_\_\_ are found in chloroplasts.

- A pigments
- B stroma
- C rubisco
- D ATPs

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2 Where do light-independent reactions occur during photosynthesis?

- A mitochondrion
- B stroma in vacuoles
- C nucleus
- D stroma in thylakoids

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3 What occurs in the second phase of photosynthesis?

- A chemiosmosis produces ATP
- B light absorbed
- C light is converted into ATP
- D glucose is made from ATP

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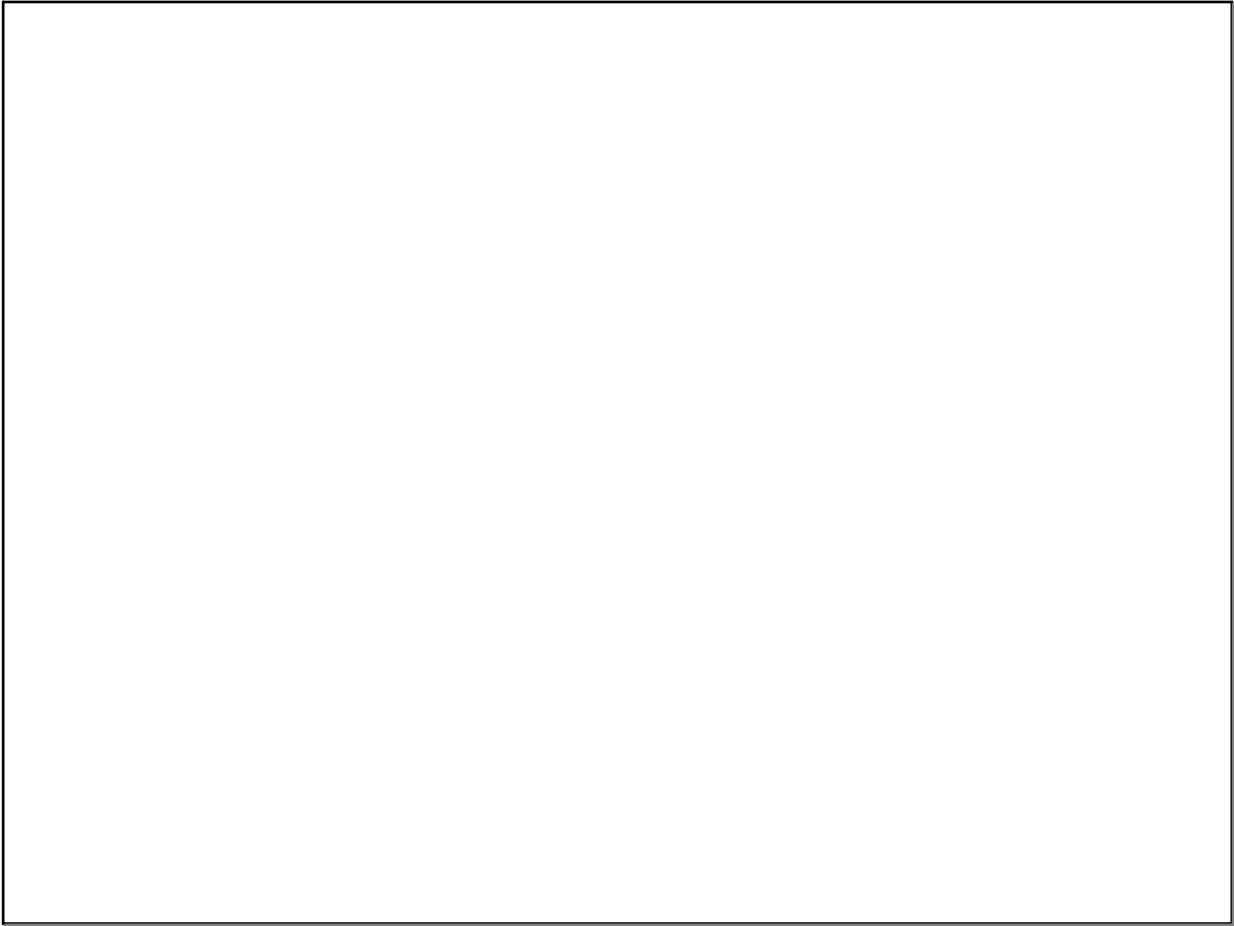
4 Which of these statements is true regarding chlorophyll?

- A It is not the only photosynthetic pigment
- B there is only one kind of chlorophyll
- C it is the only type of pigment in leaves
- D it is the rarest type of pigment in leaves

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5 Rubisco is the enzyme that converts inorganic carbon dioxide into organic carbon dioxide that can be used during the Calvin cycle.

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